

CLAIMS

What is claimed is:

1. A panel and fastener assembly comprising:
a fastener having generally parallel channel-shaped grooves, each groove
5 having a bottom wall, opposed sidewalls, a mid-portion and opposed open end portions;
said panel being plastically deformed into said grooves to define a mating region of said panel, said mating region being against said bottom wall and said opposed sidewalls defining a panel bottom surface adjacent said bottom wall, a
10 first side surface adjacent one of said opposed sidewalls and a second side surface adjacent the other one of said opposed sidewalls, said first side surface having a greater width at said opposed open end portions.
2. The panel and fastener assembly of claim 1 wherein said first side surface width increases from about said mid-portion to said opposed open end
15 portions.
3. The panel and fastener assembly of claim 1 wherein said first side surface has a generally uniform width along a middle portion of said first side surface adjacent said mid-portion and opposed outer portions which are generally wedge-shaped.
- 20 4. The panel and fastener assembly of claim 1 wherein said mating region is generally U-shaped in cross-section.
5. The panel and fastener assembly of claim 1 wherein said fastener opposed sidewalls are inclined inwardly to form a restricted groove opening.
6. The panel and fastener assembly of claim 1 wherein said opposed
25 sidewalls and said bottom wall meet at a radiused portion.
7. The panel and fastener assembly of claim 1 wherein said fastener includes a generally central pilot portion which cuts a slug from and protrudes through said panel.
8. The panel and fastener assembly of claim 7 further including

opposed flange portions on opposed sides of said pilot portion, said grooves being positioned between said pilot portion and said flanges, said flange having panel bearing faces bearing against said panel.

9. A method of attaching a fastener to a deformable metal panel, said
 5 fastener having generally parallel channel-shaped grooves, each groove having opposed sidewalls, a mid-portion and opposed open end portions, said method comprising:

locating said panel on a die member having spaced generally parallel projecting lips adapted to be received in said fastener grooves;

- 10 locating said fastener opposite said panel with said fastener grooves aligned with said die member lips;

driving said fastener against said panel, thereby driving said die member lips into said fastener grooves and deforming portions of said panel into said

- 15 fastener grooves; and

said die member lips substantially simultaneously driving said panel portions in said fastener grooves longitudinally toward said open end portions of said grooves

and laterally toward said sidewalls of said grooves.

- 20 10. The method of attaching a fastener to a deformable metal panel as defined in Claim 9, wherein said method includes deforming said panel portions in said fastener grooves laterally to a greater extent as said panel portions approach said open end portions of said grooves, forming opposed wedge-shaped bottom walls in said panel portions engaging a bottom wall of said fastener
 25 grooves and said sidewalls at said grooves.

11. The method of attaching a fastener to a deformable metal panel as defined in Claim 9, wherein said method includes deforming said bottom walls of said panel portions laterally from adjacent said mid-portion of said grooves, forming opposed wedge-shaped portions extending from adjacent said mid-

portions of said grooves.

12. The method of attaching a fastener to a deformable metal panel as defined in Claim 10, wherein said method includes deforming said bottom walls of said panel portions laterally from a location spaced from said mid-portion of said grooves, forming opposed wedge-shaped portions adjacent said open end portions of said grooves.

13. The method of attaching a fastener to a deformable metal panel as defined in Claim 9, wherein at least one of said groove side-walls of each of said grooves is inclined inwardly, said method including forming said panel portion laterally beneath said inclined sidewalls of said grooves.

14. A method of attaching a fastener to a deformable metal panel, said fastener having generally parallel channel-shaped grooves, each groove having a bottom wall, opposed side walls, a mid-portion and opposed open end portions, said method comprising:

15 locating said panel on a die member having spaced generally parallel projecting lips configured to be received in said fastener grooves;

locating said fastener opposite said panel with said fastener grooves aligned with said die member lips;

20 driving said fastener against said panel, thereby driving said die member lips into said fastener grooves and deforming portions of said panel into said fastener grooves against said bottom walls of said grooves; and

driving said panel portions in said fastener grooves longitudinally toward said open end portions of said grooves and laterally toward said side walls of said grooves adjacent said open end portions forming opposed generally wedge-shaped

25 bottom walls in said panel portions engaging said bottom wall of said grooves.

15. The method of attaching a fastener to a deformable metal panel as defined in Claim 14, wherein said method includes deforming said bottom walls of said panel portions laterally from adjacent said mid-portion of said grooves,

forming said opposed wedge-shaped portions in said bottom walls of said panel portions extending from adjacent said mid-portion of said grooves.

16. The method of attaching a fastener to a deformable metal panel as defined in Claim 14, wherein said method includes deforming said bottom walls of said panel portions laterally from a location spaced from said mid-portion of said groove forming said opposed wedge-shaped portions adjacent said open end portions of said grooves.

17. A die member comprising:
a body having an end face;
a pair of opposed clinching lips protruding from said end face, said clinching lips being generally parallel to one another;
said clinching lips having a generally flat end surface for engaging a panel to which a fastener is to be installed, a base which is integral to said end face and an outer sidewall, said sidewall joining said end surface and said base, said end surface having a mid-point and opposed ends with said end surface being wider at said mid-point than at said opposed ends, and said base being wider than said end surface.

18. The die member of claim 17 wherein said end surface narrows gradually from about said mid-point to said opposed ends.

19. The die member of claim 17 wherein said end surface begins to narrow gradually a spaced distance on either side of said mid-point.

20. The die member of claim 17 further including an opening extending through said body and said end face.

21. The die member of claim 20 further including inner sidewalls spaced from said outer sidewall, said inner sidewalls positioned about said opening.

22. The die member of claim 17 further including a pair of opposed staking lips protruding from said end face, said staking lips being generally parallel to one another and generally perpendicular to said clinching lips.

23. The die member of claim 22 wherein said staking and clinching lips are joined at this free end by corners to form a continuous protrusion.